CLAIMS

What is claimed is:

1. A method comprising:

performing a first elemental search over a highest-order elementary modulation on a received signal vector that includes multiple elements, wherein the first elemental search is performed within a first search space and produces an identified vector of elementary modulation symbols;

transforming the received signal vector to a new origin that corresponds to the identified vector, resulting in a transformed, received signal vector; and

performing a subsequent elemental search on the transformed, received signal vector, wherein the subsequent elemental search is performed within a reduced search space defined by the identified vector, and wherein the subsequent elemental search produces a next identified vector of elementary modulation symbols.

2. The method of claim 1, wherein the received signal vector is modulated using quadrature amplitude modulation, and quadrature phase shift keying is an elementary modulation.

3. The method of claim 1, wherein the received signal vector is modulated using pulse amplitude modulation, and binary phase shift keying is an elementary modulation.

4. A method comprising:

performing a first quadrature phase shift keying (QPSK) search on a received signal vector that includes multiple elements, wherein the first QPSK search is performed within a first search space and produces an identified QPSK vector;

transforming the received signal vector to a new origin that corresponds to the identified QPSK vector, resulting in a transformed, received signal vector; and

performing a subsequent QPSK search on the transformed, received signal vector, wherein the subsequent QPSK search is performed within a reduced search space defined by the identified QPSK vector, and wherein the subsequent QPSK search produces a next identified QPSK vector.

5. The method of claim 4, further comprising:

producing the received signal vector, wherein each of the multiple elements corresponds to a signal received by one of multiple receive antennas of a multiple-input multiple-output receive antenna array.

6. The method of claim 4, further comprising:

scaling the transformed, received signal vector, prior to performing the subsequent QPSK search.

7. The method of claim 4, further comprising:

until the subsequent QPSK search results in a next identified QPSK vector that corresponds to a constellation point,

repeating transforming the transformed, received signal vector; and

repeating performing the subsequent QPSK search.

8. The method of claim 4, further comprising:

incorporating a tree-searching algorithm into either or both the first QPSK search and the subsequent QPSK search to produce multiple identified QPSK vectors that are used to define the reduced search space.

9. The method of claim 8, wherein incorporating the tree-searching algorithm comprises:

incorporating an M-algorithm tree search into a QPSK search.

10. The method of claim 8, wherein incorporating the tree-searching algorithm comprises:

incorporating a T-algorithm tree search into a QPSK search.

11. The method of claim 4, further comprising:

producing search results that include at least one soft decision for use by a decoder.

12. The method of claim 11, wherein producing the search results comprises:

producing the at least one soft decision as a set of log-likelihood ratios or approximations of log-likelihood ratios.

13. The method of claim 4, further comprising:

producing search results that include de-mapped bit values corresponding to a QPSK vector identified as a result of a lowest-level search.

14. A method comprising:

performing a first quadrature phase shift keying (QPSK) search on a received signal vector, $\mathbf{Y}$, which includes multiple elements, wherein the first QPSK search is performed within a first search space and produces an identified QPSK vector; and

until a reduced search space corresponds to a QPSK constellation,

canceling higher-order interference based on the identified QPSK vector and scaling the multiple elements within the received signal vector according to $\tilde{\mathbf{Y}}_k = \frac{1}{2}\left(\tilde{\mathbf{Y}}_{k-1} - \hat{\mathbf{x}}_{k-1}\right)$, where $\tilde{\mathbf{Y}}_k$ is a scaled version of the received signal vector at search level k, and $\hat{\mathbf{x}}_k$ is a QPSK vector at search level k, and

performing a level-k QPSK search according to

$\hat{\mathbf{x}}_k = \underset{QPSK\ vectors\ \mathbf{x}}{\arg\min} \left\| \tilde{\mathbf{Y}}_k - \mathbf{H}\mathbf{x} \right\|^2$, where $\mathbf{H}$ is a channel transfer matrix, and $\mathbf{x}$ is a transmit signal vector.

15. The method of claim 14, further comprising:

incorporating a tree-searching algorithm into either or both the first QPSK search and the level-k QPSK search to produce multiple identified QPSK vectors that are used to define the reduced search space.

16. The method of claim 14, further comprising:

producing search results that include at least one soft decision for use by a decoder.

17. The method of claim 16, wherein producing the search results comprises:

producing the at least one soft decision as a set of log-likelihood ratios or approximations of log-likelihood ratios.

18. The method of claim 14, further comprising:

producing search results that include de-mapped bit values corresponding to a QPSK vector identified as a result of a lowest-level search.

19. A computer-readable medium having program instructions stored thereon to perform a method which, when executed within a multiple-input multiple-output device, results in:

performing a first quadrature phase shift keying (QPSK) search on a received signal vector that includes multiple elements, wherein the first QPSK search is performed within a first search space and produces an identified QPSK vector;

transforming the received signal vector to a new origin that corresponds to the identified QPSK vector, resulting in a transformed, received signal vector; and

performing a subsequent QPSK search on the transformed, received signal vector, wherein the subsequent QPSK search is performed within a reduced search space defined by the identified QPSK vector, and wherein the subsequent QPSK search produces a next identified QPSK vector.

20. The computer-readable medium of claim 19, wherein performing the method further results in:

incorporating a tree-searching algorithm into either or both the first QPSK search and the subsequent QPSK search to produce multiple identified QPSK vectors that are used to define the reduced search space.

21. The computer-readable medium of claim 19, wherein performing the method further results in:

producing search results that include at least one soft decision for use by a decoder.

22. The computer-readable medium of claim 19, wherein performing the method further results in:

producing search results that include de-mapped bit values corresponding to a QPSK vector identified as a result of a lowest-level search.

23. An apparatus comprising:

multiple receive antennas operable to receive multiple received signals; and

a symbol-processing element, operable to

perform a first quadrature phase shift keying (QPSK) search on a received signal vector that includes multiple elements corresponding to the multiple received signals, wherein the first QPSK search is performed within a first search space and produces an identified QPSK vector;

transform the received signal vector to a new origin that corresponds to the identified QPSK vector, resulting in a transformed, received signal vector; and

perform a subsequent QPSK search on the transformed, received signal vector, wherein the subsequent QPSK search is performed within a reduced search space defined by the identified QPSK vector, and wherein the subsequent QPSK search produces a next identified QPSK vector.

24. The apparatus of claim 23, wherein the symbol-processing element is further operable to:

incorporate a tree-searching algorithm into either or both the first QPSK search and the subsequent QPSK search to produce multiple identified QPSK vectors that are used to define the reduced search space.

25. The apparatus of claim 23, wherein the symbol-processing element is further operable to:

produce search results that include at least one soft decision for use by a decoder.

26. The apparatus of claim 23, wherein the symbol-processing element is further operable to:

produce search results that include de-mapped bit values corresponding to a QPSK vector identified as a result of a lowest-level search.

27. A multiple-input multiple-output communication device, comprising:

multiple receive antennas operable to receive multiple received signals; and

a symbol-processing element, operable to

perform a first quadrature phase shift keying (QPSK) search on a received signal vector that includes multiple elements corresponding to the multiple received signals, wherein the first QPSK search is performed within a first search space and produces an identified QPSK vector;

transform the received signal vector to a new origin that corresponds to the identified QPSK vector, resulting in a transformed, received signal vector; and

perform a subsequent QPSK search on the transformed, received signal vector, wherein the subsequent QPSK search is performed within a reduced search space defined by the identified QPSK vector, and wherein the subsequent QPSK search produces a next identified QPSK vector.

28. The multiple-input multiple-output communication device of claim 27, wherein the symbol-processing element is further operable to:

incorporate a tree-searching algorithm into either or both the first QPSK search and the subsequent QPSK search to produce multiple identified QPSK vectors that are used to define the reduced search space.

29. The multiple-input multiple-output communication device of claim 27, wherein the symbol-processing element is further operable to:

produce search results that include at least one soft decision for use by a decoder.

30. The multiple-input multiple-output communication device of claim 27, wherein the symbol-processing element is further operable to:

produce search results that include de-mapped bit values corresponding to a QPSK vector identified as a result of a lowest-level search.